PATENT ABSTRACTS OF JAPAN

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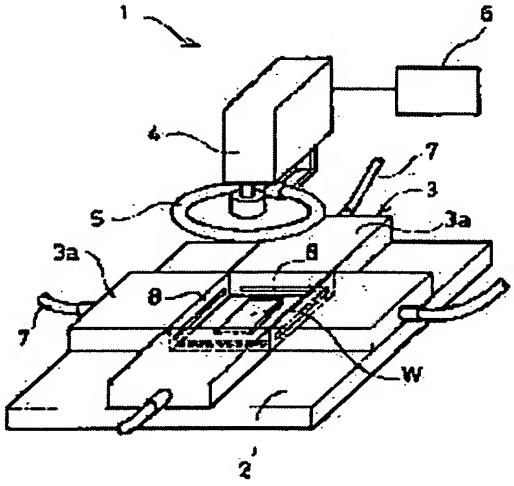
(54) WORK CHIP DETECTOR

(57)Abstract:
PURPOSE: To obtain a work chip detector which enables the detection of work chips in any shape.
CONSTITUTION: A work chip detector is provided with image pickup means 4 and 13 which are arranged above work W to take an image of the work W, side lighting means 3 and 19 to light the work W from the side thereof. The side lighting means 19 is preferably provided with a lighting body 16 to irradiate illumination light toward the work W from above the work W and a reflector section 12 which is arranged outside the side of the work W to reflect the illumination light of the lighting body 16 to the side of the work W.



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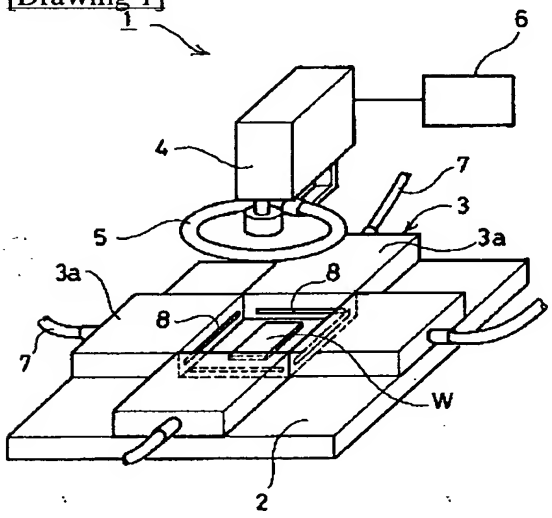
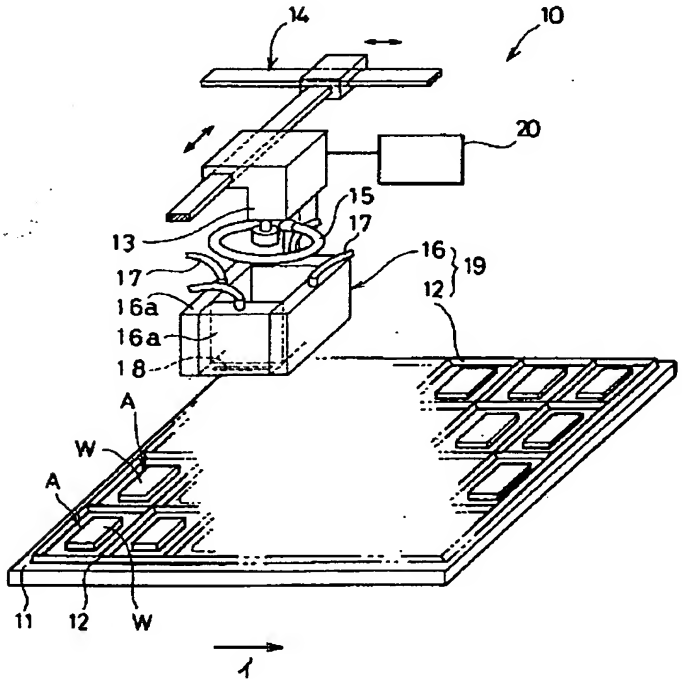
DRAWINGS

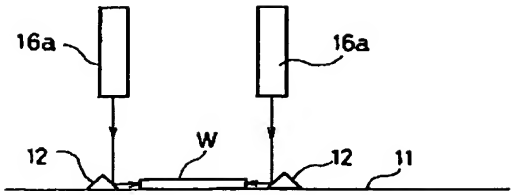
[Drawing 1]



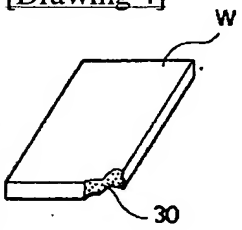
[Drawing 2]



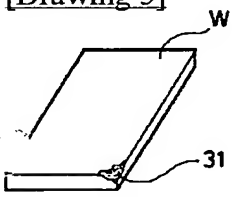
[Drawing 3]



[Drawing 4]



[Drawing 5]



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CLAIMS

[Claim(s)]
[Claim 1] Work-piece deficit detection equipment characterized by having an image pick-up means (4 13) to be arranged above a work piece (W) and to picturize the image of this work piece (W), and a side lighting means (3 19) to illuminate a work piece (W) from the side.
[Claim 2] Work-piece deficit detection equipment according to claim 1 characterized by to have the reflecting mirror section (12) which said side lighting means (19) is arranged on the lighting object (16) which irradiates the illumination light towards a work piece (W) from the upper part of a work piece (W), and the outside of a work-piece (W) side face, turns the illumination light of said lighting object (16) to the side face of a work piece (W), and reflects.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention is used when detecting the deficit of for example, a ceramic work piece, and it relates to ** work-piece deficit detection equipment.
[0002]
[Description of the Prior Art] As this conventional kind of work-piece deficit detection equipment While illuminating the work piece which possessed a VTR camera, a lighting lamp, and the image data-processing section, and was arranged by the position with a lighting lamp The image data which picturizes the image which looked at the work piece from the upper part with a VTR camera, and starts the image pick-up in the image data-processing section For example, there are some which carry out data processing of the change of a work-piece visible outline when a deficit arises, carry out comparison collating of the work-piece visible outline in case there are a work-piece visible outline and a deficit in case there is no deficit, and detected the deficit of a work piece.
[0003]
[Problem(s) to be Solved by the Invention] By the way, if it was in the above work-piece deficit detection equipments, since it was what detects the deficit of a work piece from change of the visible outline, there was a problem of also producing that whose detection is impossible depending on the condition of the deficit.
[0004] If it is the case of the deficit 30 which penetrates that table rear face to the plate-like work piece W as shown, for example in drawing 4 when this problem is concretely explained with reference to drawing 4 and drawing 5 and VTR camera ****** will be carried out from the upper part of a work piece W, since that deficit 30 is picturized as change of the visible outline of a work piece W, detection of that deficit 30 is easy for it.
[0005] However, not only the deficit 30 as shown in drawing 4 as a deficit generated to a work piece W but the surface section deficit 31 generated only at one edge on the rear face of a table as shown in drawing 5 may exist.
[0006] If it is in such a surface section deficit 31 and a work piece W is picturized from the upper part with a VTR camera Even if the surface section deficit 31 cannot recognize as an image, consequently picturizes with a VTR camera about the work piece W of such a surface section deficit 31, the surface section deficit 31 stops appearing in image data as visible-outline change. At the work piece W of a result and this drawing 5 , there was a problem that it will be processed as a work piece W without a deficit.
[0007] In view of such a technical problem, it succeeds in this invention, and even if it is the deficit of what kind of configuration, it aims at offer of detectable work-piece deficit detection equipment.
[0008]
[Means for Solving the Problem] This invention constituted work-piece deficit detection equipment equipped with an image pick-up means to be arranged above a work piece and to picturize the image of this work piece, and a side lighting means to illuminate a work piece from the side, in order to attain the above-mentioned object. In addition, as for said side lighting means, it is desirable to have the lighting object which irradiates the illumination light towards a work piece from the upper part of a work piece, and the reflecting mirror section which is arranged on the outside of a work-piece side face, turns the illumination light of said lighting object to the side face of a work piece, and is reflected.
[0009]
[Function] According to the configuration of claim 1, since a work piece is illuminated from the side, the deficit produced on the work-piece side face will begin to be illuminated clearly.
[0010] Moreover, according to the configuration of claim 2, since work-piece side lighting can be performed from the work-piece upper part, side lighting can be performed also to the work piece which carried out two or more parallel arrangements on the flat surface.

[0011]
[Example] Hereafter, this invention is explained to a detail based on the example shown in a drawing. Drawing 1 is the perspective view of the work-piece deficit detection equipment of the example 1 of this invention. This work-piece deficit detection equipment 1 is equipped with the side lighting section 3 arranged on the work-piece installation side 2, the VTR camera 4 arranged in the work-piece installation side 2 upper part, the upper part lighting section 5 which illuminates the work-piece installation side 2 from the upper part, and the image data-processing section 6.
[0012] The side lighting section 3 consists of four lighting box 3a, and the illumination light is supplied to these lighting box 3a from the source of lighting which is not illustrated by the fiber cable 7. These lighting box 3a surrounds work-piece installation side 2 center, and is arranged at the four way type, and the illumination-light bleedoff slit 8 is formed in the central-site side face of each lighting box 3a. The upper part lighting section 5 consists of a ring type lighting object (for example, ring fluorescent lamp), surrounds the VTR camera 4 and is arranged in the work-piece installation side 2 upper part. The image data-processing section 6 carries out the image processing of the image data of the work piece W which the VTR camera 4 picturized, and detects the deficit.
[0013] The deficit detection activity of the work piece W by this work-piece deficit detection equipment 1 (for example, ceramic work piece) is made as follows. That is, a work piece W is laid on the work-piece installation side 2. The illumination light is irradiated by each side face of the laid work piece W from the illumination-light bleedoff slit 8 of each lighting box 3a. Moreover, the illumination light is irradiated by the top face of a work piece W from the upper part exposure section 5. The image of the work piece W which began to be illuminated by each lighting sections 3 and 5 is picturized with the VTR camera 4, and the image data is inputted into the image data-processing section 6.
[0014] The image visible outline (profile) and the lightness difference in an image are computed here, and, as for the image data inputted into the image data-processing section 6, the existence of a deficit is detected by the calculation result. That is, when the penetration deficit 30 as shown in the work piece W at drawing 4 exists, a discontinuous configuration generates the image obtained with the upper VTR camera 4 in the visible outline. The image data-processing section 6 detects this discontinuous configuration, and the existence of the penetration deficit 30 is recognized. Moreover, when the surface section deficit 31 as shown in a work piece W at drawing 5 exists, in the obtained image data, a lightness difference arises in the surface section deficit 31 and its perimeter. This is for a difference to arise at the include angle which the illumination light of the side lighting section 3 reflects in the VTR camera 4 side, and for the difference in this angle of reflection to appear as a lightness difference in the lateral portion and the normal lateral portion of a perimeter of the work piece W which the surface section deficit 31 produced. And the image data-processing section 6 detects such a lightness difference, and the existence of the surface section deficit 31 is recognized.
[0015] Although the deficit was detected for every work-piece W item in the above-mentioned example 1, he is trying to detect continuously the existence of the deficit of two or more work pieces W in the example 2 which following-**. That is, this work-piece deficit detection equipment 10 is equipped with the work-piece installation plate 11. The work-piece installation plate 11 has the magnitude which can lay two or more work pieces W, and is divided in a grid pattern by every [of each work piece W] installation field A by the reflecting mirror section 12. The reflecting mirror section 12 consists of a triangle pole object which carried out mirror plane processing of the outside surface, surrounds the four way type of each work-piece installation field A, and is arranged. The work-piece installation plate 11 is conveyed in the direction of I in drawing according to the migration device which is not illustrated.
[0016] The VTR camera 13 is arranged above the work-piece installation side 11. The VTR camera 13 is attached in the XY mobile robot 14 at one, and is arranged movable along the direction of a flat surface of the work-piece installation plate 11. The upper part lighting section 15 which becomes the VTR camera 13 from a ring type lighting object is attached in one. The upper part lighting section 15 surrounds the lens section of the VTR camera 13, and is arranged. Moreover, the side lighting object 16 is attached in the VTR camera 13 at one. The side lighting object 16 is arranged between the VTR camera 13 and the work-piece installation side 11. The side lighting object 16 consists of total of four lighting boxes 16a, and is arranged centering on the direction of a lens center line of the VTR camera 13 at the four way type. The field surrounded by these lighting box 16a has magnitude equivalent to each work-piece installation field A, and each lighting box 16a is located in the reflecting mirror section 12 upper part. The illumination light is supplied to each lighting box 16a from the source of lighting which is not illustrated by the fiber cable 17. The illumination-light bleedoff slit 18 is formed in the base of each lighting box 16a. The side lighting section 19 consists of this side lighting object 16 and the reflecting mirror section 12. And the image data-processing section 20 which processes the image data which the VTR camera 13 picturized is formed.

[0017] Thus, as mentioned above, the constituted work-piece deficit detection equipment 10 separated the side lighting object 16 in the work-piece installation plate 11, has arranged it to the upper part, and it has combined the side lighting section 19 with the work-piece installation plate 11 and the XY mobile robot 14 which can contain two or more work pieces W further. Therefore, deficit detection processing can be performed now succeeding two or more work pieces W. That is, the work piece W is contained to each work-piece installation field A of the work-piece installation plate 11. And it conveys to the lower part of the VTR camera 13 according to the conveyance device in which the work-piece installation plate 11 which contained the work piece W is not illustrated. After conveyance is completed, the deficit of each work piece W is continuously detected with the XY mobile robot 14, moving the VTR camera 13, the upper part lighting section 15, and the side lighting object 16 along with the work-piece installation plate 11. Since the illumination light irradiated by going caudad from lighting box 16a is reflected in a work-piece W side-face side by the reflecting mirror section 12 at this time as shown in drawing 3 , a work-piece W side face will be illuminated like the side lighting section 3 of an example 1. Thus, the image of the illuminated work piece W is picturized with the VTR camera 13, the image processing of the image data is carried out in the image data-processing section 20, and the existence of the deficit of each work piece W is detected. Since this image data processing is the same as that of the thing of an example 1, that explanation is omitted.

[0018] After deficit detection is completed, while driving the conveyance device which is not illustrated again and conveying the work-piece installation plate 11 in a process [degree] construction location, the work-piece installation plate 11 which contained the new deficit detection work piece W is carried in to the bottom of work-piece deficit detection equipment 10, and the deficit detection activity which described above again is carried out.

[0019]

[Effect of the Invention] As mentioned above, according to the configuration of claim 1 of this invention, since the work piece was illuminated from the side, the deficit produced on the work-piece side face will begin to be illuminated clearly, not only the penetration deficit of a work piece but the surface section deficit formed in the surface part of a work-piece side face can be certainly detected now, and work-piece W deficit detection precision improved.

[0020] Moreover, according to the configuration of claim 2, since work-piece side lighting was performed from the work-piece W upper part, side lighting could be performed also to the work piece which carried out two or more parallel arrangements on the flat surface. Therefore, together with the configuration of claim 1, the deficit of two or more work pieces can be detected now often [precision] and promptly.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective view showing the configuration of the work-piece deficit detection equipment of the example 1 of this invention.
[Drawing 2] It is the perspective view showing the configuration of the work-piece deficit detection equipment of an example 2.
[Drawing 3] It is the explanatory view showing the condition of the work-piece side lighting by the side lighting section of an example 2.
[Drawing 4] It is the perspective view showing the configuration of the penetration deficit of a work piece.
)rawing 5] It is the perspective view showing the configuration of the surface section deficit of a work piece.
[Description of Notations]
3 19 Side lighting object lighting
4 13 VTR camera
30 31 Deficit
W Work piece

[Translation done.]